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Oak Ridge, Tennessee

REPORT NO.

KZ 3706

May 13, 1946

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NO. 2 OF 3 COPIES, SERIES CThe District Engineer
U S Engineer's Office
Manhattan District
Post Office Box E
Oak Ridge, Tennessee

Attention: Lt. Col. R. W. Cook

Dear Sir:

The method of purging cells of P.G. or C-216 in order that the systems may be opened for mechanical maintenance known in the plant as, "purge to surge", is clearly described in the attached memorandum.

There is considerable advantage in this system of operation over the use of cold traps insofar as manpower, material costs, off-stream time, and physical hazards are concerned. For this reason, the system has been adopted on a plantwide basis. In order to make the controls for this system of operating automatic, it will be necessary to make the changes shown in prints I.D. 1500 A and I.D. 1500 B. These controls are for the Plant II surge system which is being considered separately from the design changes that are now being studied for the other two plants.

Very truly yours,

CARBIDE AND CARBON CHEMICALS CORP.

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Signed/C. E. Center

C. E. Center

Plant Superintendent

APH:jo

cc: Mr. C. N. Rycker
Mr. W. B. Humes
Mr. D. H. Seeds
Mr. A. P. Huber
FileCarbide and Carbon Chemicals Corporation Operating
Contractor for the U.S. Atomic Energy Commission.

Classification changed to:

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(reason and category)

Thomas W. Selby 5/11/95
ADD or ADD Signature (first reviewer) DateJohn 7/25/95 5/12/95
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OK 082 5/30/95

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Mr. A. P. Huber
Process Building

May 8, 1946

REPORT NO.

KE 3706

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Surge for Purge

I. Theory of Operating of Purge to Surge:

The Surge for Purge is a large static volume evacuated to a low pressure, used to receive gases from a much smaller volume in which the concentration of C-616 must be lowered to a safe point. This dilution is accomplished by pressuring the small volume and equalizing with the large volume several successive times until the concentration reaches a tolerable point. In K-25 the surge systems are made up of intersectional cells connected with each other by the B spare main gallery pipe. The surge systems of the two plants of K-25 are separated from each other at 303-3, this point being chosen because of critical mass considerations in Plant I surge evacuation cold traps. The Plant II system is evacuated to cascade by the two intersectional cell pumps in 305-1.1 eliminating any Plant II critical mass difficulties. At present the surge systems are reduced to pressures of 0.1 to 0.4 psia., respectively, and three to five 3 psia. purges (or similar cycle) are necessary to purge an average size cell to what is commonly called a "negative analysis", 10 ppm of C-616.

II. Justification for Adoption of Purge to Surge:

It was found desirable to adopt a method of cell purging that would eliminate the undesirable characteristics of cold trap operation; this method of purging was highly expensive both from manpower and mechanical considerations, and slow, tedious work at best. At their fastest in Plant II, cold trap operations took six to eight hours to purge a cell. Critical mass hazards necessitated the handling of only extremely small quantities of P.G. in the traps at one time and made total time required prohibitive in the top buildings of the plant. An attempt was made to perfect on-stream purging but it was found that the cascade was unduly disrupted, and that the process was unpredictable. There was no way to tell when a negative analysis was reached other than by repeated testing. Therefore, it became imperative that another system be set up and the plan of purging to surge was placed in use. The problem of evacuating the surge system was immediately encountered and several solutions were attempted. Evacuation directly to a 312 building was tried but proved only partially successful because of the suction pressure limitations inherent in 312 operations. The most successful method for this evacuation proved to be through the use of intersectional cell pumps, and the 305-1 Intersectional Cell has been used for this purpose. This cell was selected because of its central location, which minimizes process material mixing, and because of its convenience to the 304-5 side purge. It was found that normal time for a complete purging operation in a Plant II cell was not more than 45 minutes. This was a great improvement over cold trap speed, and the convenience and

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elasticity of the surge system makes it possible to completely eliminate all cold trapping in Plant II.

The surge system was then applied to Plant I in the hope that cold trapping could be eliminated there, too. In Plant I, Purge for Surge was quite successful, however it proved more feasible to evacuate the surge with the Purge and Product Room in 302-5 than to use intersectional cell pumps. An excessive amount of G-74 would be placed on cascade with any method similar to the intersectional cell pumps. The adoption of the surge for purge system throughout E-25 has effectively made it possible to shut down three cold traps and has made available 45 operators and foremen. In contrast to this, the evacuation of the surge system in Plant II through the 305-1 Intersectional Cell requires no extra operators, and in Plant I the operation of the 302-5 Purge and Product Room and its refrigeration room necessitate one operator each.

III. Methods of Using Intersectional Cell Pumps for Plant II Surge Evacuation:

There are several ways in which the intersectional cell pumps can be utilized for Plant II surge evacuation. In operation the gas evacuated from the surge system through the intersectional cell passes through the A spare line into the top of 304-5. The 304-5 side purge then immediately takes the gas to the 312 Section, so that very little of it actually backs up to the cascade. The two intersectional cell pumps in 305-1 were originally installed to operate in parallel. There is no need for the added capacity gained by parallel operation, while there is a definite advantage in being able to reach lower suction pressures, therefore the pumps were piped in series through the 305-1 purge header. As a further modification enabling the attainment of lower pressures in the surge, C-616 was bled into the suction of these pumps, increasing the density of the gas passing through them and correspondingly increasing their compression ratios. These pumps discharge into a pressure of about 0.5 psia. which is fixed by the limitations placed on 312 section suction pressures. With the pumps in parallel a low surge pressure of approximately 0.44 psia. is attainable. With the pumps in series with no C-616 bleed, a pressure of 0.38 psia. is attainable. With a C-616 bleed a pressure of .15 psia. can be reached. It is highly advantageous to evacuate the Plant II surge system to the low pressure of .15 psia. because a greatly reduced amount of G-74 is required to purge a cell into this low pressure. Those buildings in the 303 section which are purged to the Plant II surge system are made up of cells which are quite large compared to the available surge capacity, 1600 cu. ft. to 12000 cu. ft. Purging with these volume ratios is excessively long, requiring as many as six 3 psia. purges. A large amount of G-74 is required, large enough to make C-616 losses through the 312 section alumina traps excessively high. These losses are unavoidable, and increase in direct proportion to the quantity of G-74 purged, as does maintenance on the traps themselves. With the surge system at 0.44 psia. 3300 cu. ft. G-74 are necessary, while with the surge at 0.15 psia. only 1750 cu. ft. of G-74 are necessary. To permanently instrumentate this evacuation plan it was decided to make the following installations in the 305-1 Intersectional Cell.

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1. A metal pipe connecting the discharge of the West pump with the suction of the East pump so as to place them permanently in series.

2. A positive action control valve in the line from the surge system to the suction of the West pump to enable accurate control of the flow to these pumps. This flow is directly controlled by the concentration of G-74 in 304-5, Cell 4, by the Stage 5 A pump differential pressure. This control effectively maintains a constant purge rate at the 312 side purge building.

3. A C-616 bleed running from the B normal line as it leaves 305-1 to the suction of the West pump. A control valve is to be installed in this line operated by a Solenoid valve which will commence the flow of C-616 when the pressure in the surge reduces to such a point that it becomes necessary. There is also a flow element in this line so that the density of the gas flowing through the pump can be computed at any moment, and a Crane valve so that the system may be isolated if necessary. This control valve functions as an "open or shut" valve, simply stopping or permitting C-616 to flow at the maximum flow possible at whatever differential may exist across the valve. An HBM is located on the input to this control valve so that its "open" position, and consequently the C-616 flow, may be adjusted if necessary.

The controls for this evacuation system are set up so as to be almost entirely automatic. The low pressure cut off can be set at any desired surge pressure; when this point is reached both control valves will automatically shut, placing the system out of operation. It is necessary to push a starter button when evacuation is to start, but from this point on, operation is entirely automatic. Indicator lights are installed to show when power is supplied to the entire circuit, when the evacuation control valve is open, and when the C-616 bleed valve is open. Both control valves are spring closed so that in the event of air failure the evacuation will automatically stop. While there has been no trouble in the past with surging when the pump suction valve is closed, it may be found that at high gas densities this will cause difficulty. To defeat surging, the system can be made totally recirculating by opening the pump by-pass valve to the A spare line; this is a motor operated valve and does not greatly increase operating difficulties. It was felt advisable to make the starting of the evacuation a manual operation so that in the event of a misvalving or a large air leak anywhere in the surge system the material would remain in the system until its composition had been determined. Every effort has been made to make this instrumentation as safe and as fully automatic as possible.

Signed/R. S. McClintock
R. S. McClintock

RSM

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